We claim:

1. An oxide polishing process of a copper layer on a substrate, said substrate has a top and bottom surface, comprising:

(a) providing a substrate having a top surface comprised of a copper layer area which is the top of a copper layer and a dielectric layer area that is the top of a dielectric layer;

(b) performing a first oxide polishing step at a first polish station in a polishing tool by using a polishing pad and a slurry on a platen to contact the top surface of said substrate which is held by its bottom surface on a head that has a down force and a rotational speed;

(c) rinsing the substrate with DI water;

(d) performing a second oxide polishing step at said first polish station by using said polishing pad and a slurry on a platen to contact the top surface of said substrate which is held by its bottom surface on a head that has a down force and a rotational speed; and

(e) rinsing the substrate a second time with DI water.

2. The method of claim **1** wherein the top of the copper layer has been polished in one or more previous CMP processes.

3. The method of claim **1** wherein said first oxide polish step and said second oxide polishing step are performed in a CMP tool with a slurry comprised of silica, water, and one or more additives that has a pH of about 7 to 10.

4. The method of claim **1** wherein the top surface of said substrate is further comprised of a diffusion barrier layer area at the top of a diffusion barrier layer that is comprised of TaN or one or more of Ta, Ti, TiN, WN, W, TaSiN, or TiSiN and is formed between said copper layer and said dielectric layer.

5. The method of claim **1** wherein said first oxide polishing step and said second oxide polishing step are performed at a temperature in the range of about 20°C to 30°C and with a platen rotational speed of about 40 to 70 rpm.

6. The method of claim **1** wherein said rinsing the substrate with DI water is performed with a DI water flow rate of about 500 ml/min. for a period of about 10 seconds and is comprised of a down force of about 1 psi.

7. The method of claim **1** further comprised of a polishing pad priming step between steps (c) and (d) comprised of a DI water flow rate of about 500 to 1000 ml/min. and a flow rate of an oxide slurry of about 200 to 300 ml/minute for a period of about 10 seconds while the head is raised above the polishing pad so that the top surface of the substrate does not make contact with said polishing pad.

8. The method of claim **1** wherein said second oxide polishing step comprises an oxide slurry flow rate of about 300 ml/minute and a down force of about 1 psi for a period of about 15 seconds.

9. The method of claim **1** wherein said rinsing the substrate a second time with DI water comprises a DI water flow rate of about 500 to 1000 ml/min., a down force of about 1 psi, and a rotational speed of about 40 rpm for a period of about 20 seconds.

10. A chemical mechanical polish (CMP) flow sequence for polishing a substrate with a top and bottom surface during the fabrication of a copper interconnect, comprising:

(a) providing a substrate having an opening with a top, bottom, and sidewalls formed therein, said opening is filled with a conformal diffusion barrier layer on the sidewalls and bottom of the opening and a copper layer on said diffusion barrier layer wherein said diffusion barrier layer and copper layer extend above the top of said opening and the top surface of the substrate is comprised of a copper layer area at the top of the copper layer to be polished;

(b) performing a first CMP process at a first polish station using a polishing pad and a slurry on a platen to remove a portion of the copper layer so that the polished copper layer becomes coplanar with said diffusion barrier layer, said substrate is held by its bottom surface on a head that has a down force and a rotational speed;

(c) performing a second CMP process at a second polish station using a polishing pad and a slurry on a platen to remove a portion of the diffusion barrier layer and a portion of the polished copper layer so that the polished diffusion barrier layer and the twice polished copper layer become coplanar with the top of the opening, said substrate is held by its bottom surface on a head that has a down force and rotational speed; and

(d) performing a third CMP process which is an oxide polishing process at a third polishing station using a slurry and a polishing pad on a platen to form a smoother top surface comprised of a diffusion barrier area at the top of the polished diffusion barrier layer and a copper layer area at the top of the twice polished copper layer,

and to remove residues from previous CMP processes, said substrate is held by a head that has a down force and a rotational speed and wherein said third CMP process comprises:

(1) performing a first oxide polishing step;

(2) rinsing the substrate with DI water;

(3) performing a second oxide polishing step; and

(4) rinsing the substrate a second time with DI water.

11. The method of claim **10** wherein said first oxide polishing step and said second oxide polishing step are performed in a CMP tool with a slurry that has a pH of about 7 to 10 and is comprised of silica, water, and one or more additives.

12. The method of claim **10** wherein said first oxide polishing step and said second oxide polishing step are performed at a temperature in the range of about 20°C to 30°C with a platen rotational speed of about 40 to 70 rpm.

13. The method of claim **10** wherein said first oxide polishing step comprises a down force of about 2 psi and an oxide slurry flow rate of about 300 ml/minute for a period of about 20 seconds.

14. The method of claim **10** wherein said rinsing the substrate with DI water is performed with a DI water flow rate of about 500 ml/min. for a period of about 10 seconds and is comprised of a down force of about 1 psi.

15. The method of claim **10** further comprised of a polishing pad priming step at the third polishing station after step (2) and before step (3) comprised of a DI water flow rate of about 500 to 1000 ml/min. and a flow rate of an oxide slurry of about 200 to 300 ml/min. for a period of about 10 seconds while the head is raised above the polishing

pad so that the top surface of said substrate does not make contact with said polishing pad.

16. The method of claim **10** wherein said second oxide polishing step comprises an oxide slurry flow rate of about 300 ml/min. and a down force of about 1 psi for a period of about 15 seconds.

17. The method of claim **10** wherein said rinsing the substrate a second time with DI water comprises a DI water flow rate of about 500 to 1000 ml/min., a down force of about 1 psi, and a rotational speed of about 40 rpm for a period of about 20 seconds.

18. The method of claim **10** wherein the first CMP process, second CMP process, and third CMP process are performed in the same CMP tool which is integrated with a spin-rinse dryer module to dry the substrate.

19. The method of claim **10** wherein the CMP flow sequence is implemented as part of a damascene process and the damascene process is performed a plurality of times on a substrate to fabricate a plurality of copper layers that form a stacked copper structure.